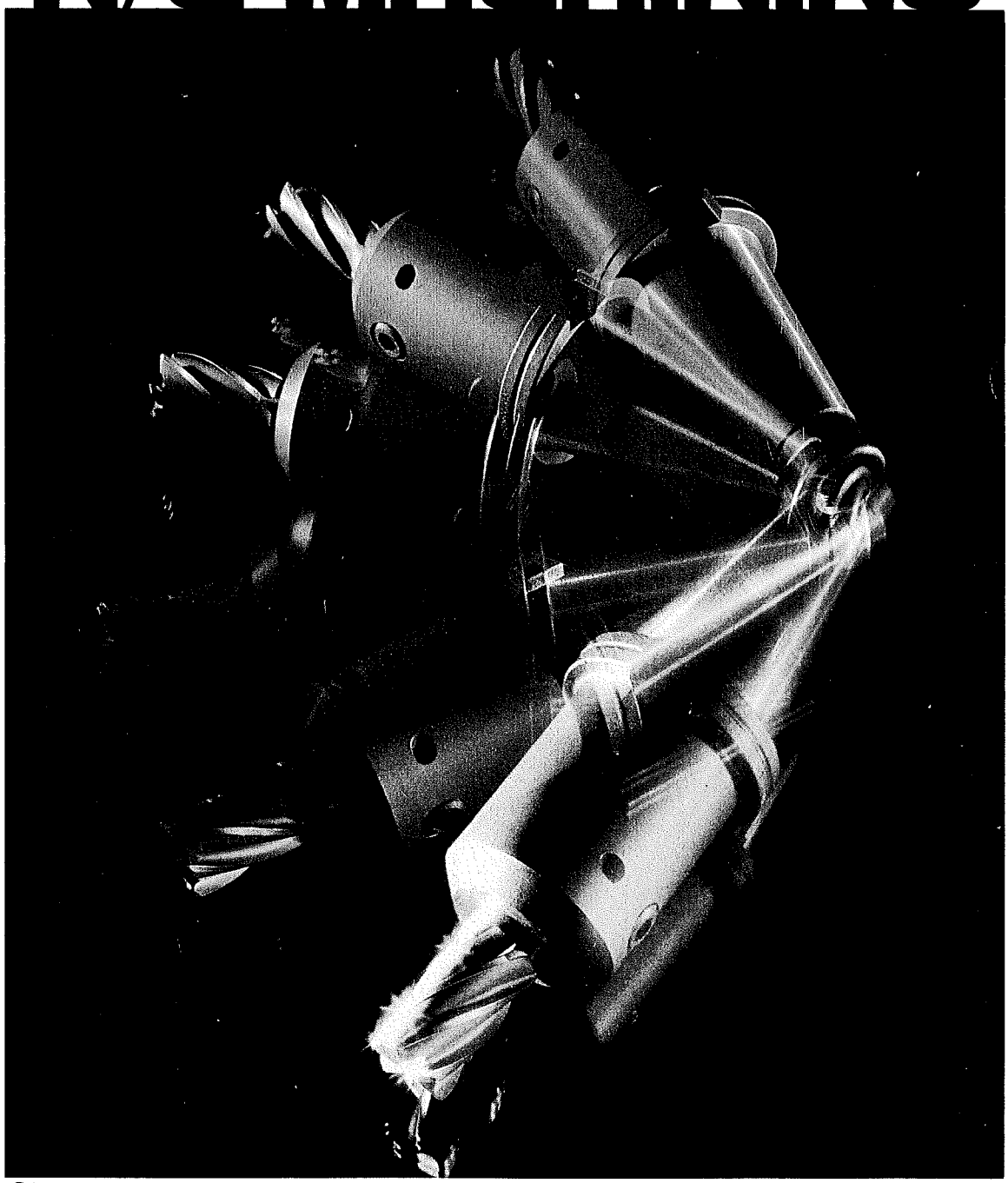
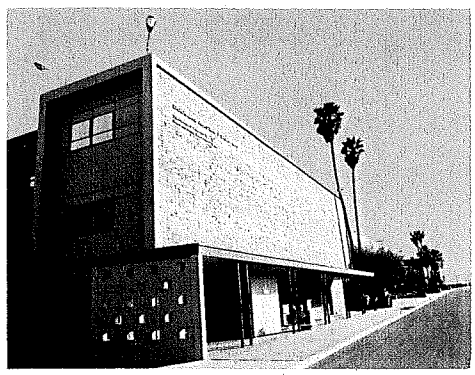
Torrance Fabrication

N/C MACHINING

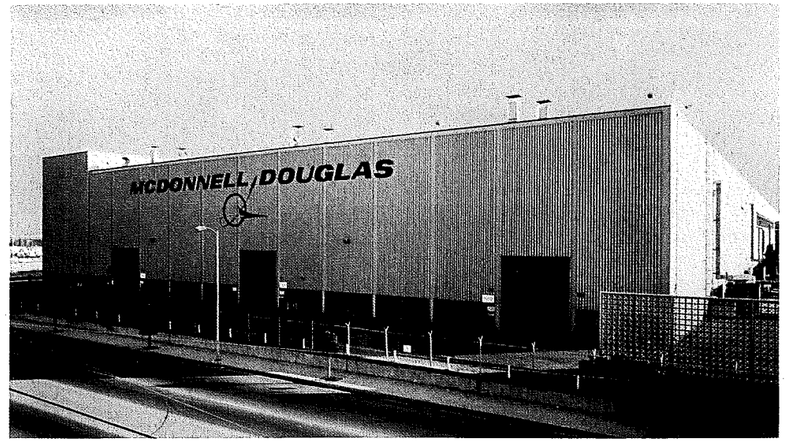


OUR SOLUTION TO YOUR MACHINING PROBLEMS

MCDONNELL DOUGLAS

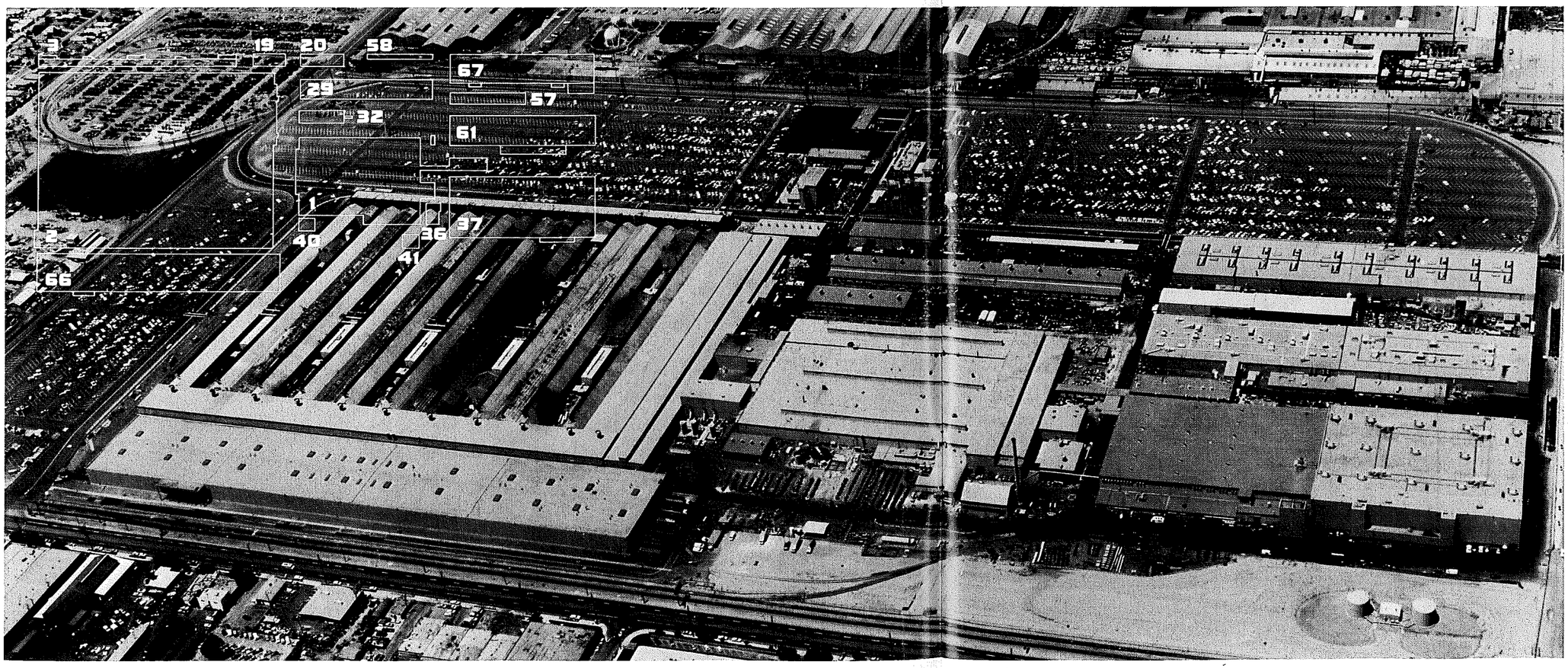


McDonnell Douglas Corporation's major facility for fabrication, located in Torrance, California, is one of the largest machine shops of its kind in the world. Torrance Fabrication, as the complex is known, operates hundreds of state-of-the-art machines, utilizes nearly a million square feet of facility space, and is a leader in the move to extremely efficient and economical Direct Numerical Control operation. All of the Torrance advantages, including the facility's experienced personnel, are available to meet your machining requirements.



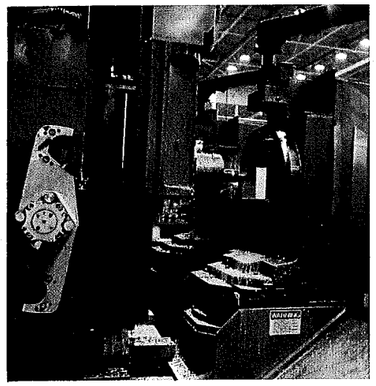
Torrance Fabrication operates in an ideal Southern California locale, which facilitates rapid shipment of machined parts via land, air, rail, and sea transportation. Situated adjacent to the San Diego Freeway and near to the Long Beach, Harbor, and Artesia freeways, Torrance Fabrication is only minutes from Los Angeles International Airport and convenient to Los Angeles-Long Beach harbor facilities as well as to major railroad arteries.

Numerical Control (N/C) machining at Torrance is performed in a structure that is divided into five work centers for greater control of in-process parts. These work centers are linked to five in-process inspection areas where specialists check dimensional accuracy on all first article machined parts. N/C equipment, layout, operating personnel, and on-site maintenance combine to offer the customer the optimum in machining capability.



TORRANCE CAPABILITIES

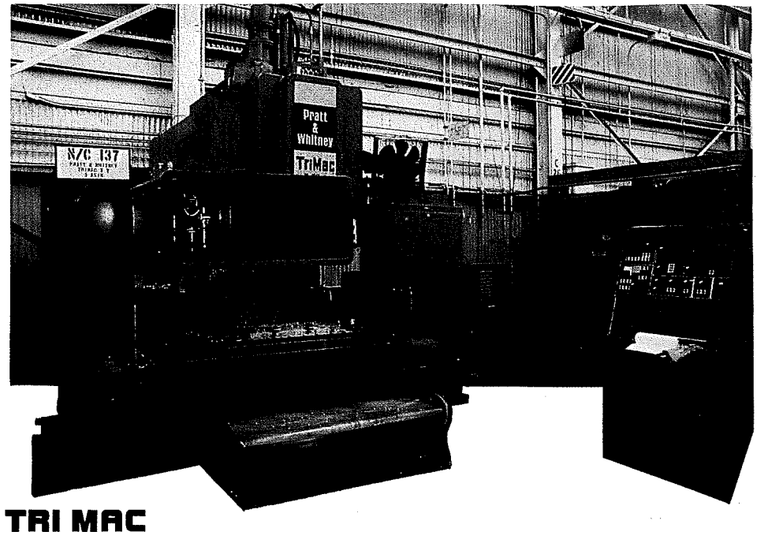
3-Spindle, 5-Axis Large Bed Mill
5-Spindle, 5-Axis Profiler
2-Spindle, 3-Axis Large Bed Mill
4-Spindle, 5-Axis Profiler
4-Axis Machine Center (Bar Fed)
4-Spindle, 5-Axis Large Profiler
1-Spindle, 5-Axis Large Profiler
3-Spindle, 5-Axis Large Profiler
1-Spindle, 5-Axis Small Profiler
Turret Drill
1-Spindle, 3-Axis Drill & Mill
3-Axis Small Profiler
Drill
3-Spindle, 4-Axis Keller
1-Spindle, 4-Axis Machine Center
2-Spindle, 5-Axis Profiler
3-Spindle, 3-Axis Small Bed Mill
1-Spindle, 3-Axis Small Profiler
Trumpf Router
Universal Lathe
Boring Mill
3-Spindle, 3-Axis Small Profiler
Bridgeport 1-Spindle, 3-Axis Profiler
Grinder
3-Spindle K&T Mill



CIM-X MACHINING CENTERS

Our two 5-axis Cincinnati Cim-X machining centers, with 60-position tool changers, are suitable for producing a wide variety of small parts from titanium and aluminum stock. Machine capabilities include:

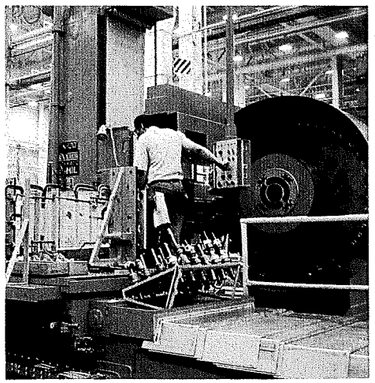
Travel of 100" in x axis
36" in y axis
28" in z axis
Two 32" x 32" rotary table workstations for multiple setup
60-cutter automatic tool changer
0.12 hp/mph to 15 hp maximum
Fifth axis is on a 30" vertical rotary angle plate



TRI MAC MACHINING CENTERS

We have recently put into production the second of two Tri Mac vertical machining centers. This equipment is ideal for producing highly configurated parts requiring extremely close tolerances. These machining centers offer the following specifications:

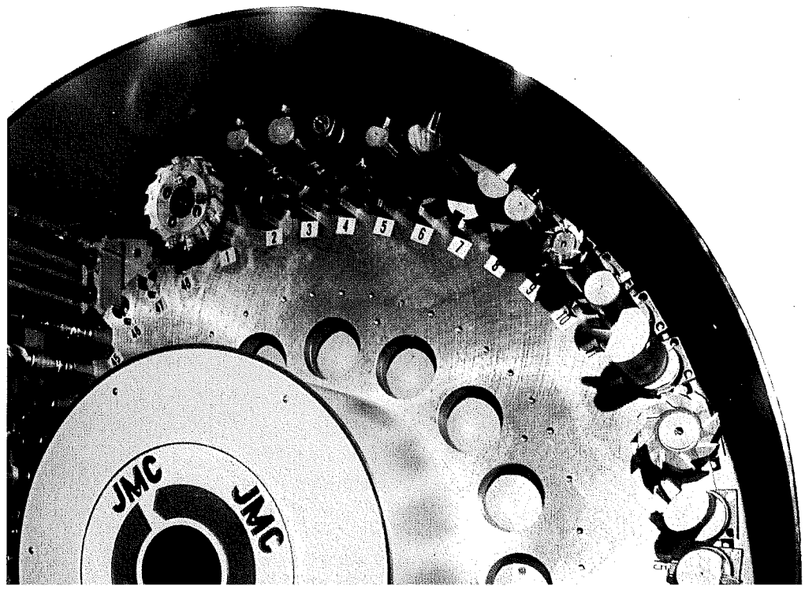
60" x 29" table with 54" travel in x axis
Carriage travel 28" in y axis
Vertical slide travel 24" in z axis
15 hp/45-3600 rpm
25-position cutter tool changer

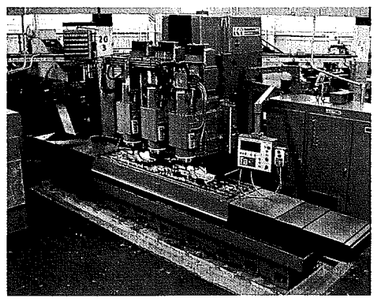


DE VLIEG JIG MILLS

Torrance Fabrication operates two De Vlieg jig mills that combine the machining of large parts with the capability of boring precision holes holding tolerance of ±0.0005. One application of these machines is the production of the main landing gear of the DC-10 airliner, which involves the machining of an 1800-pound forging to a 600-pound finished article. Specifications include:

3 axis (84" in y axis)
48-unit tool changer
30 hp





K&T MILLS

The Kearney & Trecker Data-Mill 700 unit offers 3-spindle profiling and milling capabilities that easily handle workpieces weighing as much as five tons.

27-9/16" x 118-1/8" worktable
15 hp/100-3000 rpm
Spindle center distance 24"

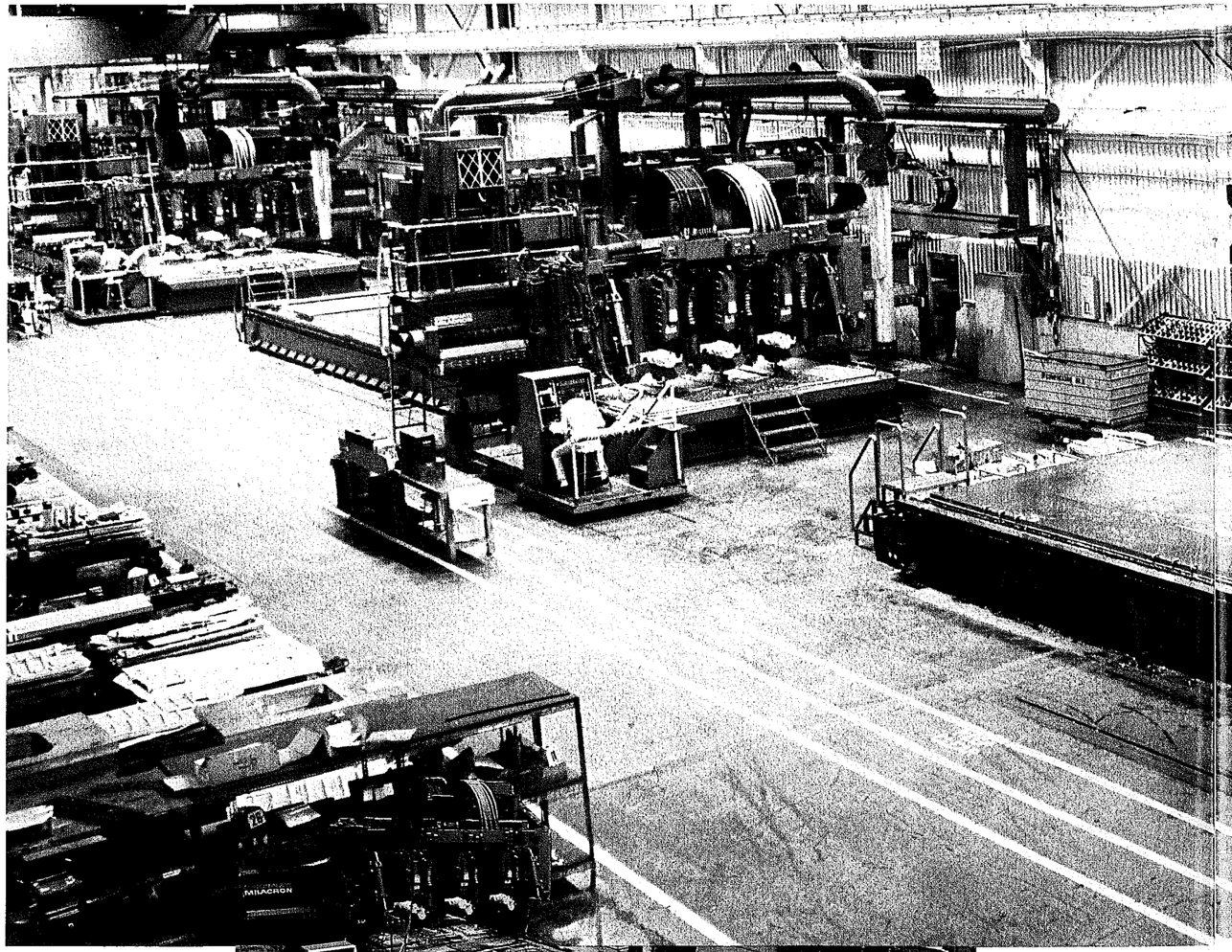
WOLVERINE PROFILE MILLS

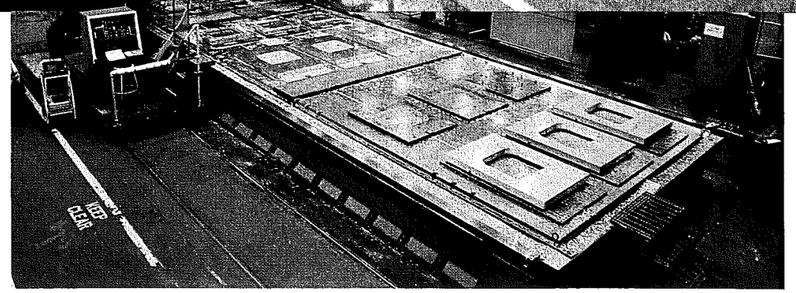
Our state-of-the-art Pratt & Whitney Wolverine line offers five 3-axis profilers for parts ranging in size from 2 inches by 2 inches by 6 inches to those as large, for example, as the F-15 fighter aircraft closure panels, which are rough machined at 3 inches by 24 inches by 36 inches. Three of our Wolverine profilers have the following specifications:

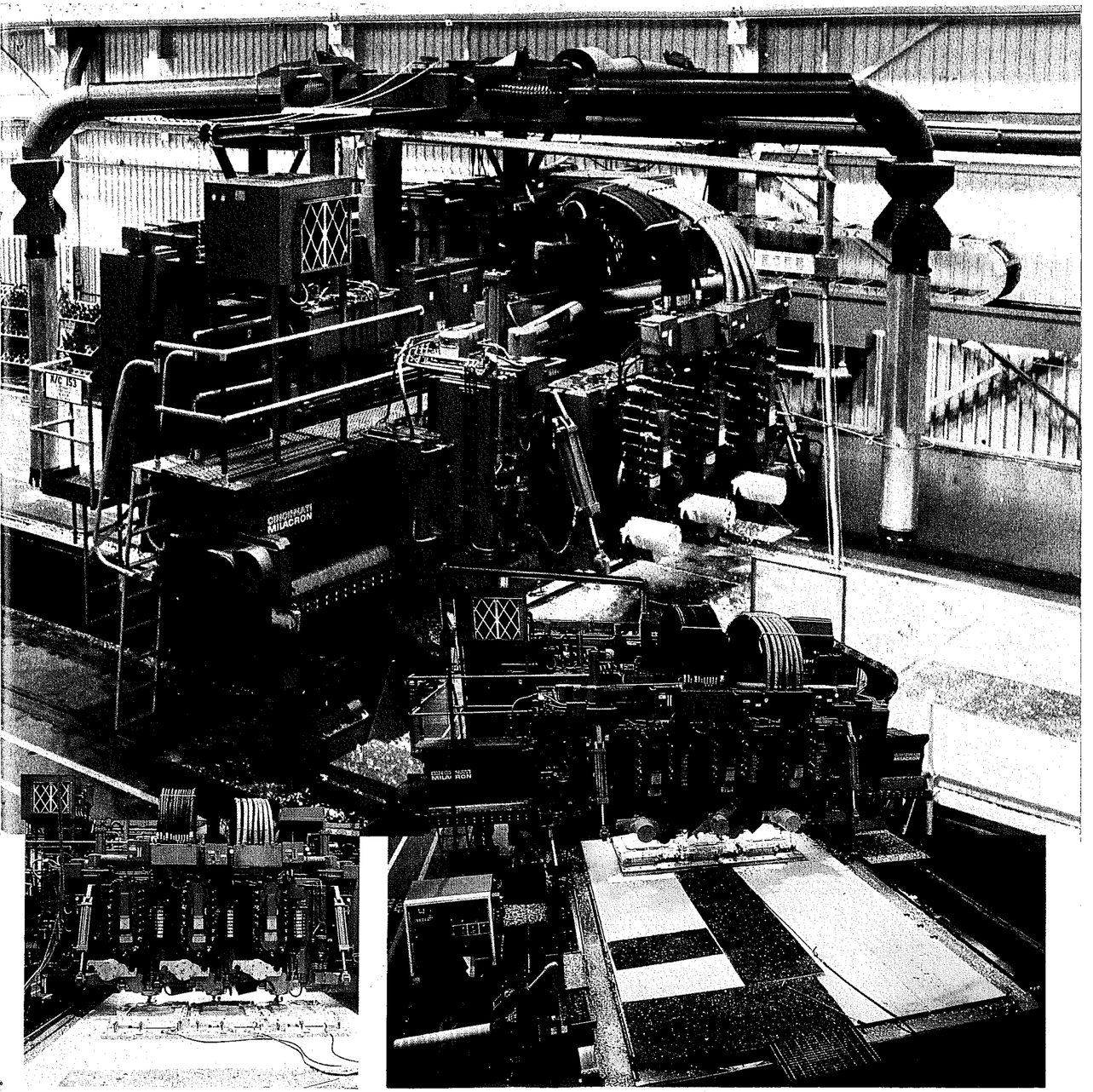
48" x 120" worktable
Table (x) 120"
Column (y) 48"
Spindle 24"
Quill 10"
xyz 1/2=50 imp
3 spindles, 13 hp each
18-1800 rpm, 24" centers

Two additional Wolverine profilers offer the following flexibility:

40" x 96" worktable
Table travel 96" x axis
40" y axis
16" z axis
3 spindles, 10 hp each
50-3000 rpm, 18" centers



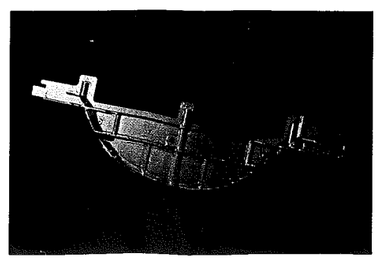


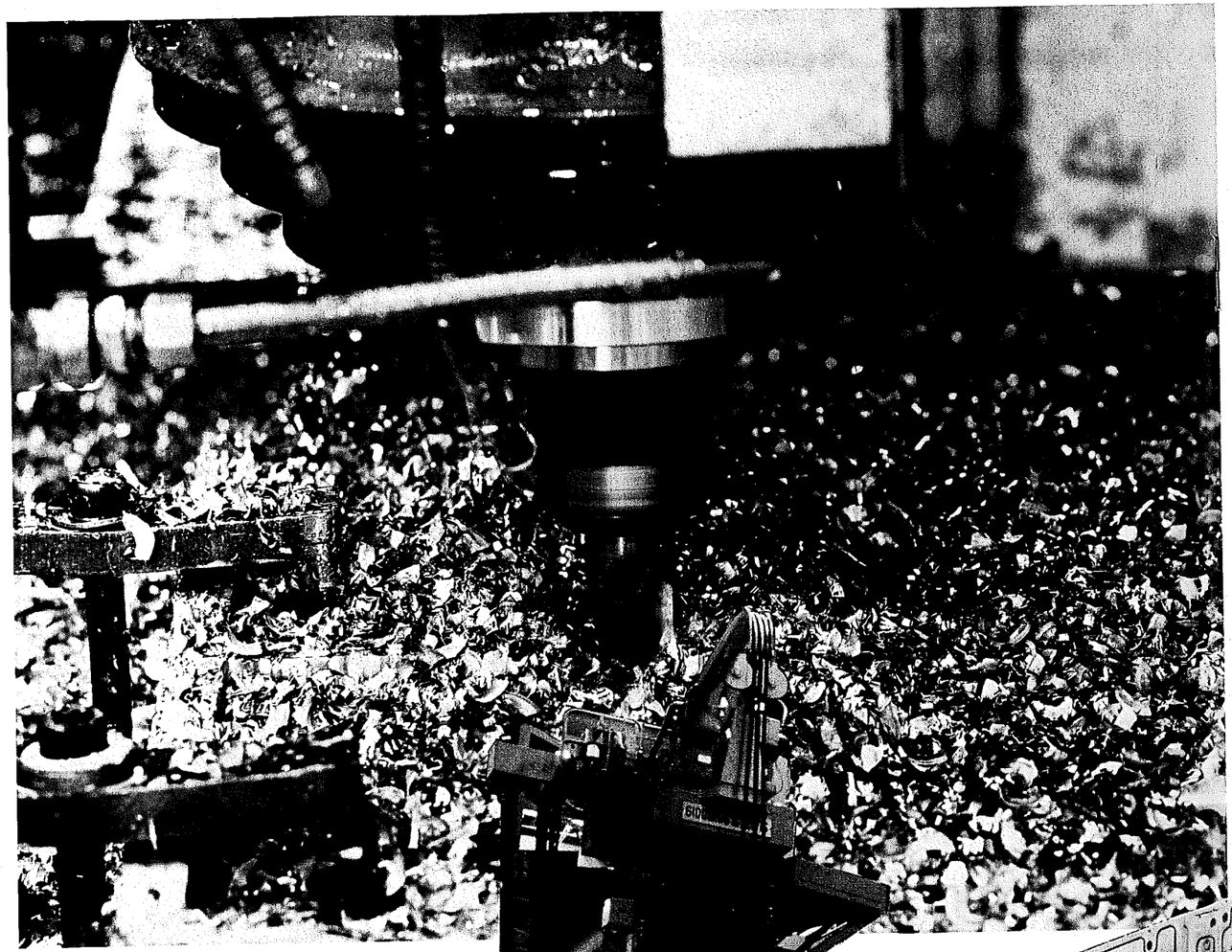


CINCINNATI GANTRY PROFILE MILLS

A major addition to our capabilities is the newly installed Cincinnati gantry mill line. Three of these mills are common, and the fourth offers increased horsepower and greater motion. Parts requiring multiple tool setups are ideally suited for the gantries as parts can be loaded and unloaded while the machine is in a cutting sequence. A typical gantry utilization is the production of closure panels for the F-15 fighter aircraft. These panels are rough and finish machined from a plate of material 3 inches thick by 24 inches wide and 36 inches long. The machining operation requires four fixtures in line to produce a finished article weighing approximately 24 pounds.

Travel of 544" in x axis
110" in y axis
18" in z axis (with one 28" in z axis)
±20° a, b axis
Three spindles at 40" o/c, one with 50" centers
30 hp/20-3600 rpm
20-cutter automatic tool changer

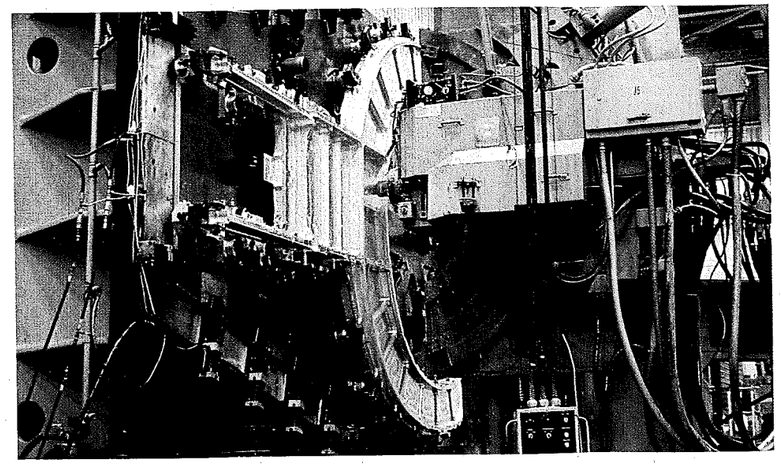




SINGLE-SPINDLE 5-AXIS VARIAX DOUBLE COLUMN

Our single-spindle, 5-axis equipment is unique in aluminum part machining capability. The above machine is joined end-to-end with an identical Variax and operated as a dual column mill with a total travel of 688 inches including overlap. The 30-hp motor and the rigidness of the unit allow heavy roughing cuts prior to finish machining.

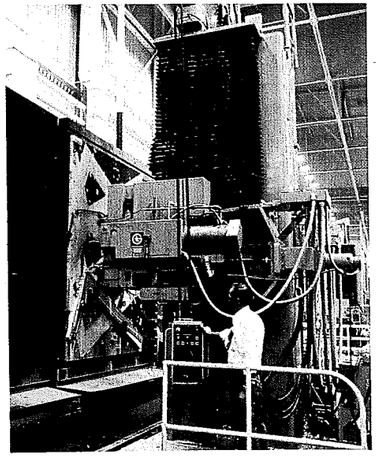
Travel of 18" x 48" x 344"
Tilt ±22-1/2°
Swivel 60°L, 20°R opposite 20°L, 60°R
30 hp/17-3600 rpm



5-AXIS VARIAX

As part of our single-spindle, 5-axis family, Torrance Fabrication has two single-spindle Variax units with a machining surface capability of 10 feet by 20 feet. Additional machine specifications include:

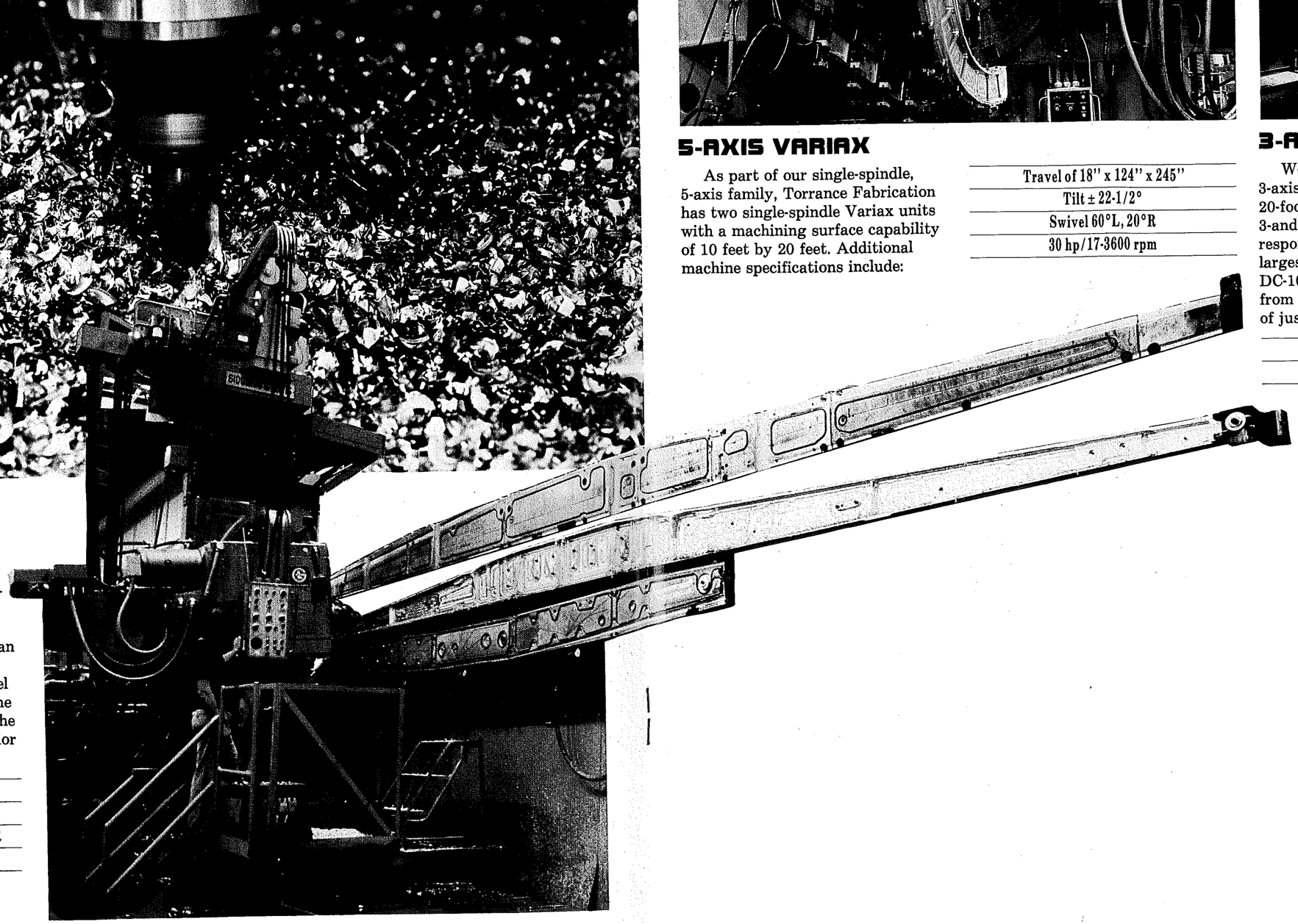
Travel of 18" x 124" x 245"
Tilt ± 22-1/2°
Swivel 60°L, 20°R
30 hp/17-3600 rpm

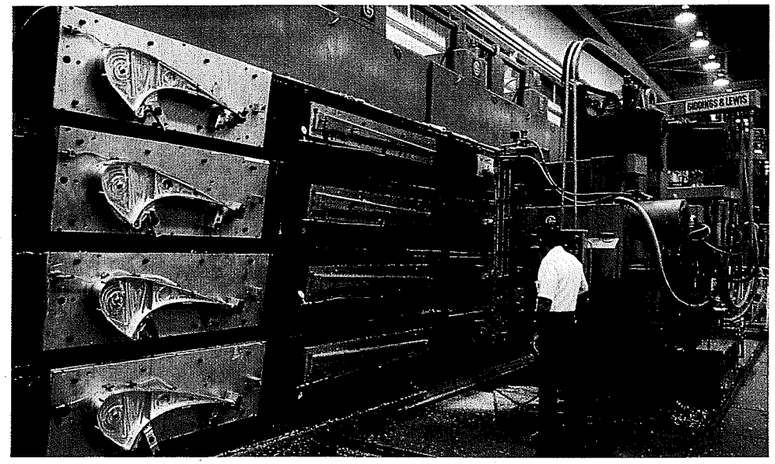


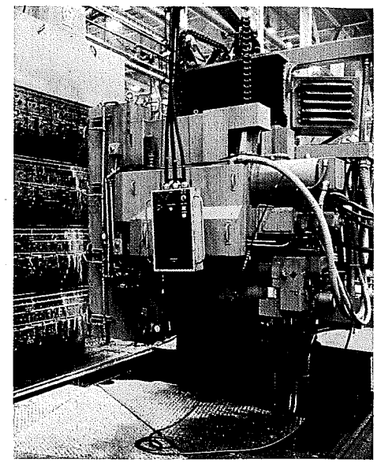
3-AXIS DI-MILL

We utilize two single-spindle, 3-axis Di-Mills that offer 10-foot by 20-foot work surfaces also. Our 3-and 5-axis N/C profilers are responsible for reducing the world's largest aluminum forgings, the DC-10 lower vertical stabilizer spars, from 4400 pounds to a finished part of just 460 pounds.

Travel of 18" x 124" x 245"
40-hp motor/17-3600 rpm







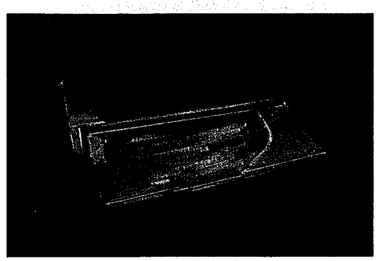
5-AXIS VARIAX PROFILERS

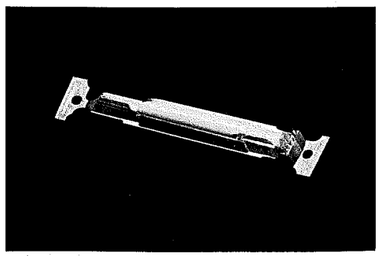
Torrance Fabrication operates three 4-spindle, 5-axis machine lines, consisting of 13 Variax profilers in two different lengths and horsepowers. Among the titanium and aluminum parts they produce are the F-15 aircraft titanium spars, which are rough and finish machined. These parts are 4 inches wide tapering to 1 inch in width and span 10 feet in length with nominal floor and wall thicknesses of 0.050. Four of these machines have the following specifications:

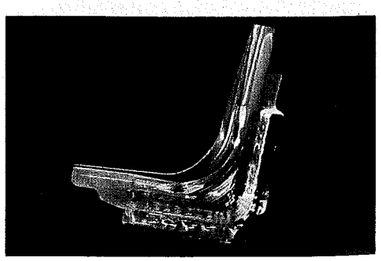
Four 18" x 240" workface platens
Tilt ±45°
Swivel 60°L, 20°R
30 hp/17-3600 rpm (spindles at 24" o/c)

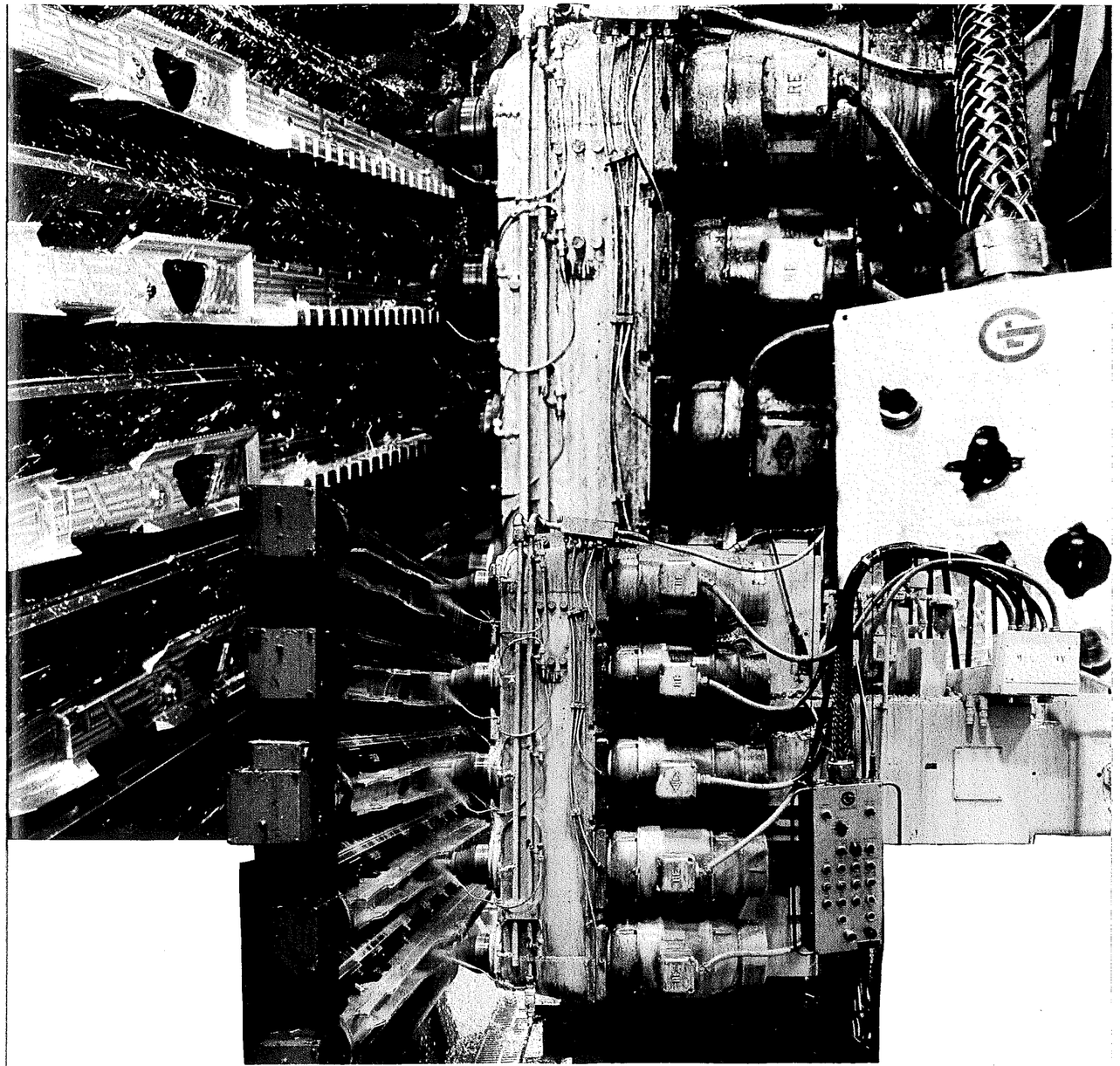
Nine other 4-spindle, 5-axis Variax profilers offer the following:

Four 18" x 168" workface platens
Tilt ±45°
Swivel 60°L, 20°R
40 hp/17-3600 rpm (spindles at 24" o/c)





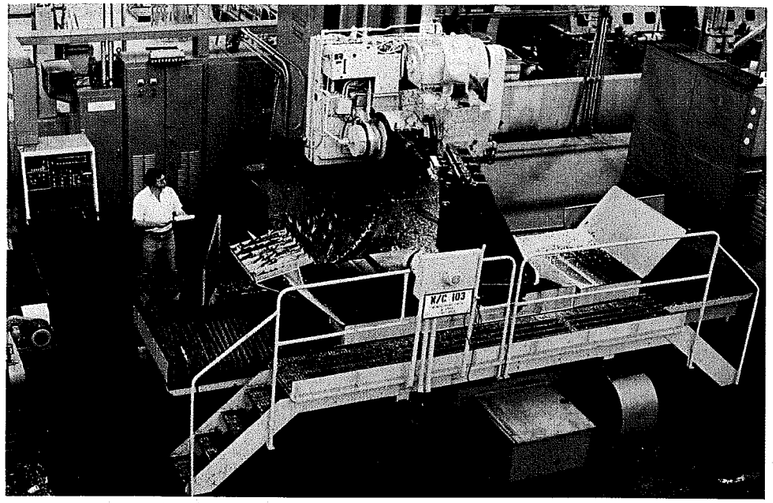




5-SPINDLE, 5-AXIS

Our 5-spindle, 5-axis machine was specially designed and fabricated by the Douglas Aircraft Company division of McDonnell Douglas. This machine retains in the 5-axis mode the three rectilinear motions and the swiveling column of the single-spindle profiler. Fifth axis is provided in the multiple tilting work holders.

Travel of 18" x 48" x 168"
Tilt ±48°
Swivel 58°L, 15°R
Five 10-hp spindles, one 20/40-hp spindle
Five 1800-rpm spindle speed, one 1800/3600-rpm spindle speed



SUNDSTRAND OM-4 SINGLE-SPINDLE PROFILERS

Our OM-4 line consists of five 5-axis profilers that produce parts ranging from the DC-10 cockpit window frames to the Space Shuttle rings measuring four feet in diameter. The OM-4s offer the following features:

96" x 72" x 72" travel with 52" rotary table – right angle head available
Spindle #1 at 10-540 rpm, 40 hp above 80 rpm
Spindle #2 at 70-3700 rpm, 40 hp

BRIDGEPORT MILLS

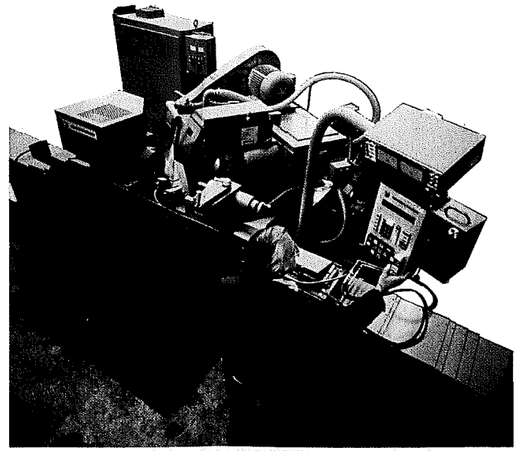
The N/C Bridgeport line for the manufacture of small parts consists of Series II 3-axis profilers. Our seven machines are scheduled for quick response in producing parts without extensive tooling delays and at a high volume production rate.

Travel of 30" x 15" x 12"
38" x 15" table
Feedrate 39 imp
4 hp/50-3500 rpm

N/C GRINDING

Our facility utilizes the new Warner & Swasey automatic 2-axis cylindrical grinding machine that combines high speed, versatility, and productivity.

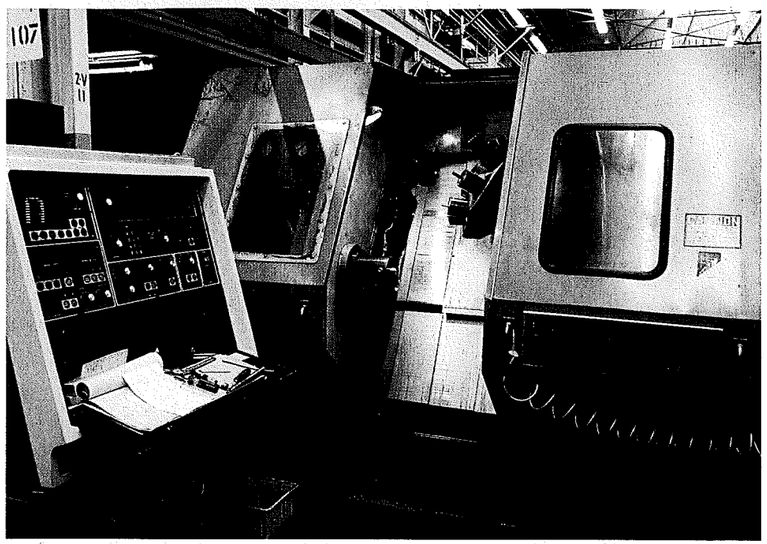
Wheel grind 8500 sfpm
Table movement 500 ipm



N/C LATHES

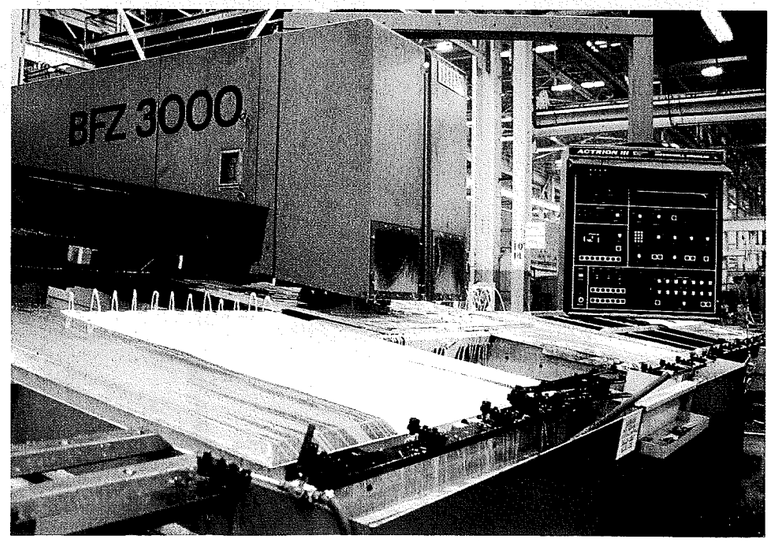
Torrance Fabrication operates three Lodge & Shipley N/C universal bar/chucker lathes suitable for machining aluminum and steel parts up to 6 inches in diameter when chucked individually. Collet sizes range from 1/2 to 2-1/2 inches in diameter.

9-1/2" swing
38" maximum length turned
Slide travel 43" longitudinal
12-1/2" facing
4" tail stock quill stroke
Spindle clearance 2-1/2" round
30 hp/90-3000 rpm



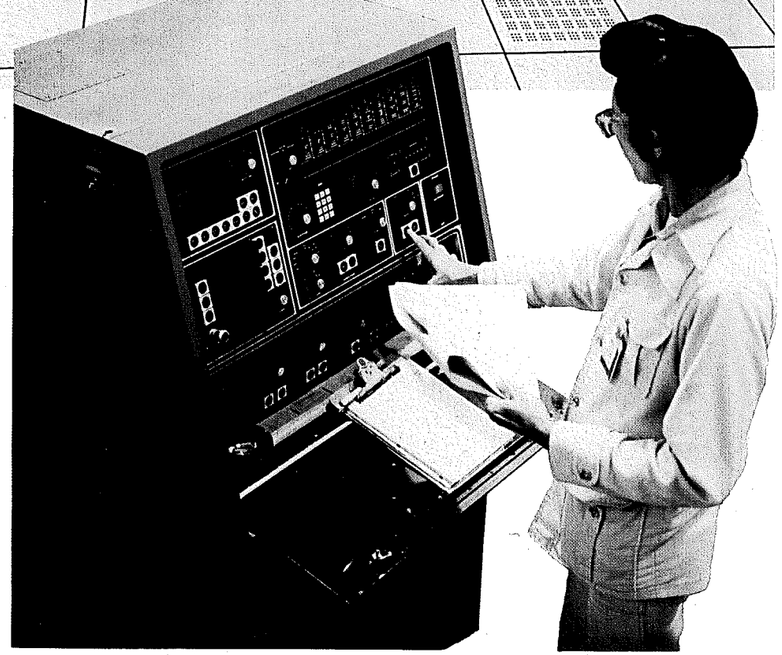
TRUMPF ROUTER

Our new Trumpf router is unique in that it eliminates 99 percent of burring, reduces waste 60 percent, and increases production to approximately 6000 pieces in one eight-hour, one-operator shift. This router also saves much of the hand or pin routing normally required in the fabrication of sheet metal parts.



PERKIN-ELMER

Our Numerical Control equipment, now numbering nearly 100 units at Torrance Fabrication, is operated through the Perkin-Elmer 3240 computer system. The 3240 is the result of McDonnell Douglas' corporate effort to design a system that is modular and adaptable to all installations where Direct N/C is desirable. Each Perkin-Elmer 3240 computer is capable of supporting 160 N/C machines.



ACTRION III

Linking the Perkin-Elmer computer to individual N/C equipment is the Actrion™ III microcomputer, developed by Actron, a division of McDonnell Douglas. The Actrion III combines high reliability with easy maintenance, and its Programmable Machine Interface (PMI) feature eliminates electromechanical relays formerly needed to interface controls to machines.

PLANNING

The Planning and Methods engineering group has the responsibility to analyze engineering data and plan the most economical machining methods. This group inputs data for incorporation into major manufacturing plans and proposals and assists in the preparation of proposal segments.

TOOL DESIGN

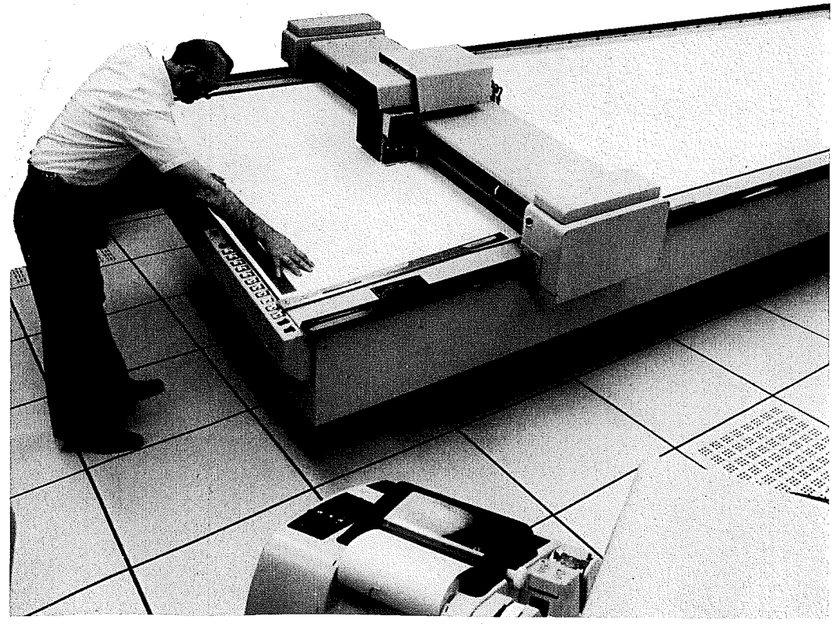
Our Tool Design group will coordinate with Programming, Planning, Methods Engineering, Production, Tool Liasion, Tool Fabrication, and Inspection departments in the development of necessary hard tools. Our N/C tool designers have the working knowledge to design tools that are not only accurate but cost effective.

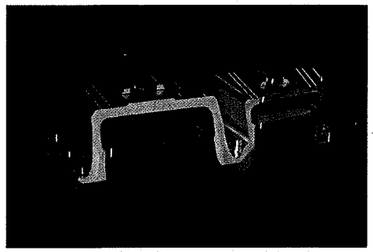
PART PROGRAMMING

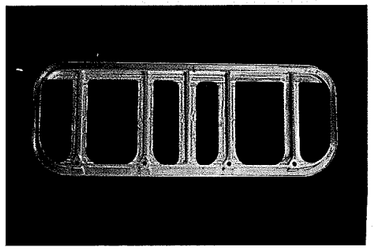
The Part Programming group supports Manufacturing by producing tools that are necessary to guide N/C machines to fabricate machined parts. Part Programming is presently staffed with nearly 70 specialists.

DRAFTING/DIGITIZING

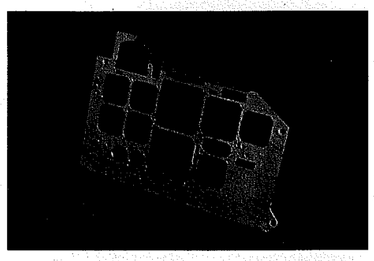
We maintain three combination flatbed drafting/digitizing machines that are able to plot N/C machine data using six colors of ink for data verification prior to production. The digitizing capability lends itself to many areas, ranging from various outlines for visual manipulation to the digitization of x-rays for computer verification.

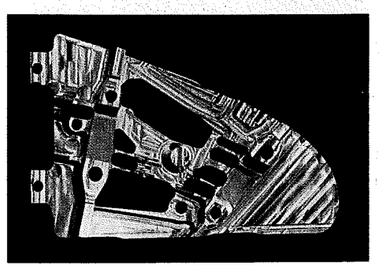


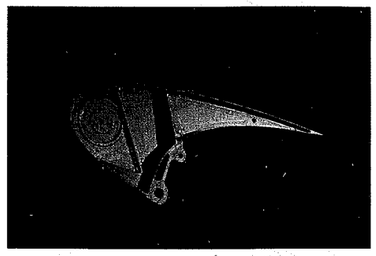


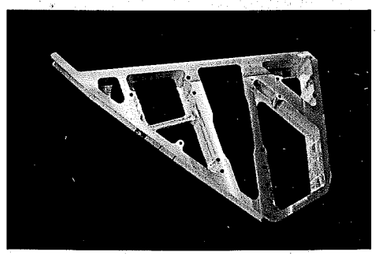


Whatever your machining problems and requirements, the Torrance Fabrication division of McDonnell Douglas Corporation has the equipment, personnel, and experience to provide a prompt and economical solution. For more information on what we can do for your company, write the Director of Fabrication, Torrance Facility, McDonnell Douglas Corporation, 190th St. and Normandie Ave., Torrance, CA 90502 or telephone (213) 533-7641.









DOUGLAS AIRCRAFT COMPANY

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MCDONNELL DOUGLAS CORPORATION

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